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Pine Engraver, Ips pini, *in the Western States*

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The pine engraver, *Ips pini* (Say), is one of the most common and widely distributed bark beetles in North America. It occurs from South Carolina north to Maine and Quebec, westward across the Northern United States and Canada to the interior of Alaska, and from there south through the Pacific Coast States and the Rocky Mountain region to northern Mexico. Its range in the Western States is shown in figure 1.

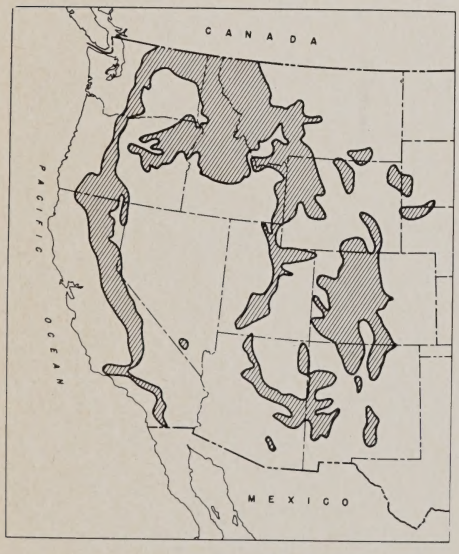

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Figure 1.—Distribution of *Ips pini* in the Western States.

Hosts

In the Western States, the insect is most important as a pest of ponderosa pine. In some localities it is an important killer of lodgepole and Jeffrey pines. Recently it has become a serious pest in plantations of jack and red pines in western Nebraska. Occasionally it kills pinyon, Coulter, limber, sugar, western white, and southwestern white (*P. strobiformis* Engelmann) pines, and probably most other pine species occurring within its range. Less frequently it also attacks Engelmann, blue, and white spruce.

Damage

In most years, the pine engraver is not important as a tree killer, even though large populations commonly infest slash, cull logs, windthrown trees, and other forest debris. Infestations in standing trees during years when the beetle population is low typically occur in widely scattered

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individuals and groups of fewer than 10 trees. Often these trees have been previously damaged by wind, snow, fire, or lightning.

In especially warm, dry years, this beetle may kill large numbers of apparently healthy saplings and poles, as well as the tops of mature trees (fig. 2). Outbreaks in unthinned young stands may result in the death of groups of 50 to more than 500 trees. In recently thinned stands, large numbers of the remaining trees may also be killed in areas 2 to 5 acres in size. The top-killing of older trees is often followed by killing attacks in the lower boles by other species of bark beetles.

the infestation ordinarily progresses from the crown downward and the boring dust lodges in bark crevices and upon the ground around the base of the tree. The foliage of infested standing trees usually begins fading within a few weeks after attack; the rate of fading is influenced by tree species and weather. Most killed trees are thoroughly faded by late summer or early fall, but some may not fade until the following spring.

Description

Ips pini has four distinct stages in its life cycle: egg, larva, pupa,

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Figure 2.—Ponderosa pines killed and top-killed by pine engraver.

The first indication of an attack by the insect is reddish-orange dust in small mounds at points of beetle entry on the upper surface of logs and slash. In standing trees

and adult. The egg is oval and pearly white and is the size of a pinhead. The larva is a yellowish-white, legless grub with a brown head. The pupa is shining white

and resembles the adult, but its wing covers are folded around its abdomen. The adult (fig. 3) is cylindrical and about 1/8 to 3/16 inch long. It has four small spines on each side of the declivity at the hind end of the wing covers. A new adult is pale yellow at first but darkens rapidly to dark reddish brown or black before flying.

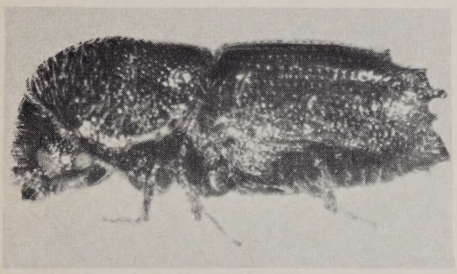

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Figure 3.—Adult pine engraver, 15 X.

Life History and Habits

Each attack is initiated by a male beetle, which bores into the inner bark and, next to the wood surface, forms a nuptial chamber several times his size. He is then joined by one to seven females, usually two or three. After mating, each female constructs a tunnel, termed an "egg gallery," in the inner bark, slightly scoring the wood surface in the process. These galleries radiate from the nuptial chamber and frequently form an inverted-Y pattern alined with the grain of the wood (fig. 4). All *Ips* species keep their egg tunnels rather free of boring dust, and this characteristic distinguishes their galleries from those of most other bark bettles.

A female lays from 30 to 60 eggs along her egg gallery, which usually ranges 4 to 7 inches long. The eggs hatch within 4 to 14 days, and the resulting larvae mine laterally from the egg gallery for about 1 to 2 inches. The

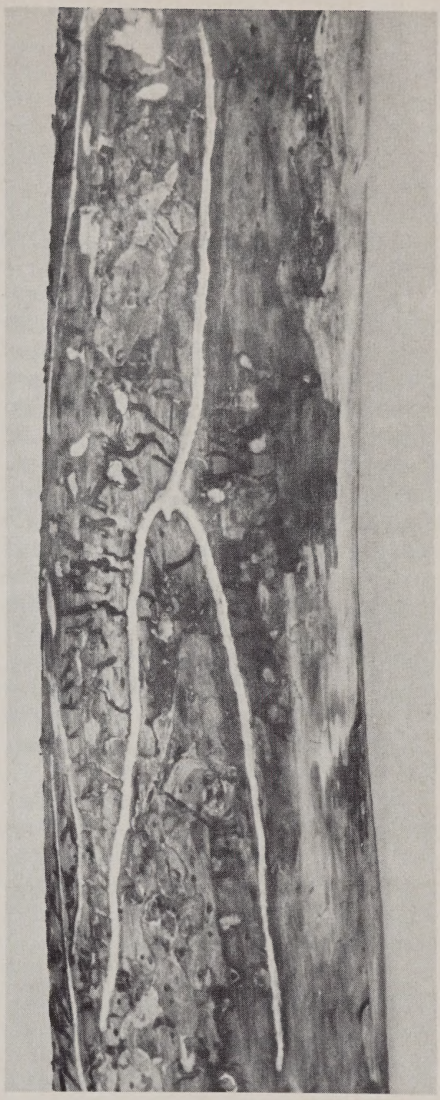

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Figure 4.—Galleries of *Ips pini* breeding attack in ponderosa pine.

larval mines, unlike the parent tunnels, are packed with shredded phloem and excrement. After about 10 to 20 days, each larva excavates an oval cell at the end of its tunnel, where pupation occurs. New adults begin to appear 2 to 12 days after pupation.

Before emerging, young beetles often congregate and feed under

the bark, sometimes for as long as a month; they may obliterate much of the gallery pattern. When mature, they bore through the bark and emerge. More than 150 new adults per square foot of bark surface may emerge from logging slash. Usually only 15 to 30 per square foot emerge from smaller material.

In a breeding attack, an average of 30 to 50 beetles attack each square foot of bark and the normal sex ratio is approximately three females per male. So-called "feeding" attacks also occur; in these there are more than 500 beetles per square foot of bark and the sex ratio is about one female per male. Feeding attacks occur mostly in July and August and coincide with the period of severe tree killing. Although eggs are sometimes laid in feeding attacks, rarely is any brood produced because the inner bark is almost totally devoured by attacking beetles (fig. 5).

In most parts of the beetle's range, two or three generations per year are common and the flight or attack season usually begins in April or May and continues until September. At high elevations in the north, only one generation occurs in some years and flights may be mainly confined to a period from June to August. As many as five generations and a February-to-November flight season reportedly may occur in southern California.

The beetle spends the winter almost exclusively in the adult stage, except in the Southwest, where some large larvae and pupae may overwinter. Populations at high elevations in the North usually overwinter in duff and litter on the forest floor, and those in the Southwest generally remain under the bark. In most localities, however, the overwintering site varies; in some years most beetles drop into the duff, and in others many remain under the bark.

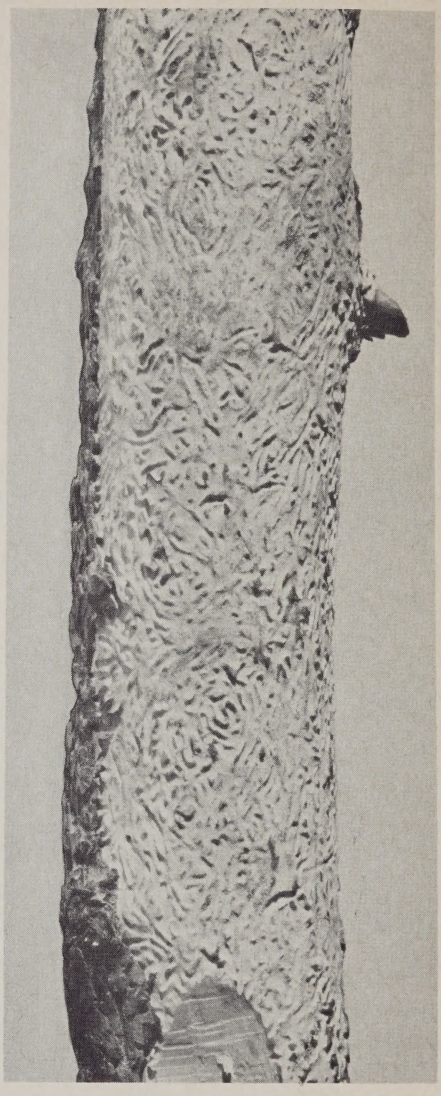

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Figure 5.—Galleries of *Ips pini* feeding attack in ponderosa pine.

Natural Control

The availability of suitable breeding materials is probably the major factor influencing the size of pine engraver populations. Competition between pine en-

gravers often lowers the density of new adult emergence from small-diameter host materials. In larger materials, competition from other bark beetles and shallow-working wood borers commonly reduces the amount of inner bark available for development of pine engraver broods. Predation by woodpeckers, beetles, flies, and mites is common and so is parasitism by wasps and nematodes. However, the effects of natural enemies upon trends in the population of the pine engraver are little understood.

Minimizing Tree Mortality

Beetles can be killed by burning infested materials or spraying them with toxic chemicals. However, these measures rarely reduce damage significantly, except possibly in the manmade forests of western Nebraska and a few other localities where severe tree killing tends to continue for more than one season. Elsewhere the use of direct control measures against the pine engraver is impractical because serious tree mortality cannot be reliably predicted far enough in advance to allow treatment. Furthermore, outbreaks rarely persist longer than a season and seldom are detected before they decline naturally.

In unmanaged stands, the key to preventing outbreaks is stand improvement through thinning or logging because serious tree killing occurs mainly in very dense young stands and decadent old ones. The need for improving stand conditions is emphasized by the fact that, within a decade or two, even more serious killing by other bark beetles frequently has followed a pine engraver outbreak.

In the event of severe, continued damage from this insect, check with your county agricultural agent, State agricultural experiment station, or local forester to get the latest control recommendations.

Outbreaks seldom follow cutting in actively growing stands. But during warm, dry years, killing of remaining trees is often serious after thinning of stagnated, even-aged stands and after overstory logging in decadent uneven-aged stands. In Oregon and Washington, killing of residual trees occurs predominantly in stands cut from spring through midsummer. Accordingly, forest managers may wish to avoid thinning during this period.

In recently logged stands, much damage can be prevented by prompt disposal of slash before it becomes infested. Where general slash disposal is impractical, tops and cull logs lodged in sapling thickets should be removed and scattered in stand openings to speed drying by the sun prior to beetle attack. In high-use recreation areas, judicious removal of injured and diseased trees and prompt disposal of fresh slash and windthrows before they are attacked will reduce potential sites of beetle aggregation and thus possible tree killing.

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